METHODS OF COYOTE CONTROL IN KANSAS

by

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INTRODUCTION

No topic in the field of wildlife management is more controversial than that of predator, especially coyote, relationships, and on none, perhaps, is there more loose thought and positive opinion based on insufficient consideration of the little evidence that is available. With the exception of the coyote, large predators are so few in number that, under present conditions, any possible effect that they may have on the total numbers of most game species and domestic stock is more theoretical than real. The general effect of concentrated predator control is so noticeable that whenever there has been a reduction in the number of coyotes in a territory where the deer or antelope populations are low, but food and environment are adequate, field workers have experienced an increase in the herds (Hansen, Barker, 1951).

There has been considerable discussion of the philosophy of predator control operations and the need for them (Gabrielson, 1947). General control participated in by state and federal agencies has been justified largely on the ground that the Federal Government owns nearly 50 percent of the land area in the western states, where the great range livestock industry is conducted, and that it is unjust to expect individual owners or groups of owners to cope with the predatory animal problems unaided. It is also argued that supervised control, with all its faults, is more selective and therefore, less wasteful of other forms of wildlife than is control by individual effort.

From Missouri westward, the coyote is abundant enough to be seriously destructive to sheep and poultry. Of all native predators, it is the one most able to take care of itself, and in the face of intense hunting, one that has consistently been able to extend its range. Control operations have been carried on against this animal by the individual effort of those affected or in a general way by bounties or organized drives. Nevertheless, the coyote has been able to hold its own in many parts of the country.

It should be pointed out that coyotes live largely on rodents, and that because of local conditions, many individual coyotes have no opportunity to destroy any form of poultry or livestock. On the other hand, a single animal may become exceedingly destructive and cause great losses to the poultry or stock raiser. Losses usually are found in more or less concentrated areas, and may at times be great enough to put operators out of business. A coyote may live largely on rodents for a number of months and then invade a poultry yard, a flock of turkeys, or a band of sheep, and in a short time do so much damage as to outweigh any good it may have accomplished by eating rodents in the previous months.

Under such circumstances the predator problem becomes not one of merely animal interrelationships, but of economics and human welfare as well. So long as it is necessary for man to maintain his herds and flocks in regions seriously infested by predators, some form of control must be exercised. The only questions are, how much control is necessary, and how shall it be undertaken. There is much room for arguments on both questions.

Canis latrans, the brush wolf, prairie wolf, or commonly called the coyote, has been "the" thorn in the side of the farmers and ranchers of Kansas since the state was first settled. His range includes the entire state, with the greatest population concentration being in the Flint Hills and big blue stem range area. His appearance is not unlike a small police dog, but with longer fur and a shorter, fuller tail. In the field it could be mistaken for a timber wolf, the obvious difference being that a coyote carries his tail low. Adult male coyotes seldom measure more than four feet, and will weigh on the average 28-30 pounds. Exceptionally large individuals may weigh 55 pounds, according to Hamilton (1943), but apparently never exceed 40 pounds in Kansas. The females are slightly smaller than the males.

The coyotes in Kansas have never been driven out or had their ranks noticeable thinned. They are apparently going to be a permanent part of Kansas wildlife, and if this is the situation that is to be, Kansans must learn to control his numbers and his depredations on domestic stock.

Although individual control of coyotes has been attempted in Kansas for many years, little or no scientific investigation of the efficiency, practicability and economy of these methods has ever been undertaken. Continued livestock and poultry losses throughout the state have mounted into the hundreds of thousands of dollars annually. The methods of control that have been employed have not only failed to decrease the coyote population, but because of failure to coordinate attempts to

control the coyotes, this loss mounted almost to the two million dollar mark in 1949.

Bounties have been paid for at least 50 years, but records were not adequately kept until 1945 and are not suitable for any study. Since 1945, however, all bounty records have been kept accurately and these were the first records upon which the coyote studies were based. A state census was conducted in 1946 and again in 1950 to determine the losses to coyotes. In 1949 the bounty was raised from one dollar per coyote scalp to two dollars. The state pays one dollar, and the counties are required by law to pay the additional dollar.

An intensive study of "Factors influencing coyote populations in Kansas" was initiated in the Zoology Department of Kansas State College in 1948. All phases of coyote biology and relationships are being considered in this study, the total results of which will be released soon and were available for use in preparation of this report.

In conjunction with this study, an examination of the principal methods of control of coyotes in Kansas was deemed necessary to evaluate their effectiveness so that recommendations for a concrete, acceptable, and effective system of coyote control could be established for Kansas.

SOURCES OF INFORMATION

Since no previous attempt at evaluation of methods of coyote control had even been attempted in Kansas, there was no literature or records other than the bounty records from the

offices of the county clerks and treasurers that could give direct information for the present study. In view of the lack of readily available information, every possible source was drawn upon for every detail that could be obtained. Information already gathered for the Kansas State College coyote study was used as a basis for further work.

The first questionaires (exhibit A) were sent to those farmers who had reported losses in 1949 and to those individuals who had cooperated otherwise in the coyote study. This was a request for information on the methods of control that were being used, the number of coyotes that had been caught and whether the methods of control were considered effective.

Since this control study began in the fall of 1950 about the time that organized "wolf hunts" were getting under way, additional questionaires (exhibit B) were sent to men known to be actively engaged in these drives, and through these first contacts names of men who were trapping and hunting coyotes were obtained. By May, 1951, more than 1,000 questionaires had been sent to farmers, hunters and other interested parties. During the summer months, additional questionaires (exhibits C and D) were sent to county clerks and treasurers, requesting information on the number of adult and pup scalps turned in for bounties during April, May and June, 1951. More specific questionaires (exhibit E) on cyanide guns, steel traps and dog packs were sent during the fall, 1951, to men who were known to be using one method only.

The Rodent and Predator Control section of the U.S. Fish and Wildlife Service began using Compound 1080 (Sodium fluoroacetate) in the southwestern part of Kansas to control coyotes in January, 1951. Information was obtained on its use from the agricultural agents in the counties in which it was used, as well as from the District Office of the U.S. Fish and Wildlife Service in Oklahoma City, Oklahoma. During the remainder of the year special attention was given to this type of control, and attempts have been made to evaluate its usefulness. The Portland, Oregon, office of the Fish and Wildlife Service contributed much information on 1080; and the game commissions of Wyoming, Utah, Oklahoma, New Mexico and Oregon, and the Izaak Walton League of America also contributed generous amounts of information.

RESULTS

DOG PACKS

Reports from the use of dog packs in coyote hunting were received from every part of the state. Thesd packs usually are not large, averaging five dogs. On occasion however, several packs have been combined for a specific hunt, so that a pack of 40 dogs is possible on a single hunt.

Two methods of hunting with dogs have been reported predominately. Many variations of these systems are used. The dogs are transported by truck or car to the area to be hunted. Trail hounds pick up the scent and follow the trail until the coyote is sighted, then coursing hounds run him down.

In the second method, the coyote is spotted either from a horse, a car or a plane, and the hounds set on him directly, usually both trail hounds and coursing hounds participating.

Replies including enough information to be used in this study were received from 27 owners of dog packs (Table 1). All of these owners indicated that their packs were taken by truck or car to the area where a coyote had been reported, and then released to hunt. These men reported that their dogs had killed 1,015 coyotes from 1949 through 1951. The exact number of packs involved was not indicated, but 152 dogs were listed as having participated in more than 600 hunts. The number of dog handlers varied from 1-12 on each hunt, with 2-4 being the average. The number of coyote-hunting dog packs in Kansas, based on the incomplete information available, probably does not exceed 200 packs.

Based on the figures received, each dog accounted for 6.6 coyotes during the year. However, if the number of times those dogs were used to hunt coyotes is considered, the picture is changed. One hundred and fifty-two dogs in 27 packs were used on 648 hunts, making an average of four dogs on each hunt, or 2,592 dog hunts. From this, it follows that 2.5 dog hunts are necessary to catch one coyote. If the estimate of 200 dog packs in the state is nearly correct, and if the others hunted on the same basis as those reporting, then possibly 8,000 coyotes could be accounted for by dogs. Actually this figure is much too high, so possibly the sample consists of the more successful hunters.

Table 1. Success of hunting with dog packs for the winter 1950-1951, unless otherwise noted.

Cooperator	Address	Coyotes killed	Dogs used	No. of hunts	No. of men
Glen Dillon	Topeka	100	12	24	3
Fred Cook	Elmont	40	4	16	5
Clifford Swain	Tecumseh (49-50)	52	4	16	12
Louis Voss	Densmore	102	3	50	2
L.C. Berry	Cimarron	38	10	25	6
J.W. Qurbin	Moline	3	3	13	
J.R. Barnes	Piedmont	14	3	20	
Chester Miller	Piedmont	8	3	15	
H.C. Murphy	Conway Springs	90	3	60	
A.A. Brown	St. John	96	16	12*	4
Howard Stemets	Clay Center	4	3	4*	1
Harry Whitney	Manhattan (49-50)	27	5	30*	3
Harry Whitney	Manhattan	24	5	30*	3
Guy Thompson	Winfield	13	10	3	8
Gerald Hittle	Dexter	25	10	14	2
Rule Bibey	Dexter	12	6	24	2
Edgar Gray	Sedan	9	4	12	1
Ben Butler	Neal	34	4	40	2
Fred Lauber	Toronto	35	5	35	3
George Chipp	Toronto	20	4	30	2
I.L. Marriott	Eureka	32	8	25	3
Lawrence Sika	Yates Center	22	4	30	
K.E. Steele	Yates Center	34	4	30	
R.E. Stockbrand	Yates Center	18	5	25*	
Fred Weide	Yates Center	30	3	20*	
L.O. Walters	Portis	101	7	26*	3
Garland Gideon	Paxico	32	4	28	2
Total		1,015	152	648	67 (Inc.)

*Estimates based on incomplete information.

It cannot be denied that the dog packs for which information was supplied accounted for many coyotes during the past two years as well as a saving in stock normally lost to these coyotes. But the question here is one of economy and efficiency. If these dogs were used but once and killed 1,015 coyotes, then they could be considered an efficient and economical means of control. However, it was necessary to use each dog for 4.2 hunts for a

total of 648 times to kill these coyotes. Each hunt required the supervision of 3.5 men.

PLANE HUNTING

A few enthusiasts have discovered that there is a great sport in chasing and shooting coyotes from planes. The general procedure seems to be a cruising flight at about 500 feet by which the animals are spotted, or flying low over heavy cover to flush the animals out. Once the coyote is in the open, it may be chased for sport, or shot.

Reports from a few hunters show real efficiency with this method. Mr. Clyde Peterson of Smith Center, who was killed in May, 1950, killed about 60 coyotes in 1949-1950. Mr. John Crow of Attica and his partner have killed 300 coyotes in 1950 and 1951. Mr. C.F. Bivens, Summerfield, reported 34 coyotes killed in 1949. Several instances of would-be coyote hunters have been noted in which the pilot has tried his luck, and got few or no coyotes.

In general, hunting from airplanes cannot be considered an effective or an efficient means of control. In the first place, the equipment is too expensive, and by expense alone the method is severely limited. Second, this sport has proved very costly in human lives, as one or two planes crash every year in Kansas, killing the hunters. Sport is increased and danger decreased when planes are used to spot coyotes, and the animals are run by dogs.

WOLF HUNTS

Beginning after Thanksgiving and lasting until the last of March, "wolf hunts" are a popular form of "coyote control". Such drives are possible at this time of the year because the coyotes have no dens, movements are free, and cover is thin so the animals are easily flushed. Snow on the ground makes them easily seen.

"Wolf hunts" may develop more or less spontaneously because of excessive losses, or they may be organized by a "Round-up Club", a group of enthusiastic hunters, or by a single man. These hunts have at least the outward appearance of being conducted for coyote control, but most of them are conducted by and manned with people who are more enthusiastic about the hunt than the kill. The number of men participating in successful drives may vary from 200 to 3,000, with an average of about 675 hunters on the hunts for which data were available. This sport is most popular in the eastern half of the state where enough hunters from the nearby cities swell the ranks of the farmers sufficiently to make tight enough lines so that few of the animals can get through.

The area selected to be hunted usually is roughly a square, with no large streams and relatively little brush in it. The hunters, armed with shotguns, are lined up along the four sides of the square at about 100 yard intervals. Hunters should never be spaced farther than 150 yards, as coyotes can and do pass unscathed through such gaps, or remain hidden while the hunters pass on each side. At a given time the lines start moving toward

the center of the square. They usually are directed by "line captains", whose job it is to see that no large gaps are permitted to occur between hunters and that the line is kept moving at a uniform rate of speed.

Coyotes caught in the open within this square are usually killed, unless they have an opportunity to slip through the line or find a good hiding place. One of the chief difficulties that was encountered on most hunts was that the hunters were not strict enough in maintaining good order on the lines, and gaps were permitted to occur through which the smart coyotes made a dash for freedom, and frequently were successful.

Data for 24 coyote drives that took place from December to March of 1950 and 1951 were available (Table 2). Approximately 18,000 men took part, and 380 coyotes are reported to have been killed. A few more animals undoubtedly died from wounds received during the hunts. The hunts covered an area over 1,200 square miles. The most popular hunts covered 36 to 50 square miles, but because of the inclusion of a few exceptionally large hunts in this report, the average covered in the hunts reported was much larger, 50.6 square miles.

Calculations based on these figures indicate that these hunts required an average of 48 men for four hours, covering an area of 3.2 square miles, to kill one coyote. The number of men multiplied by the number of hours plus the dollars that are needed to participate in such a hunt present an insurmountable obstacle insofar as the economy of such a means of control is concerned. Information on the kill of rabbits, hawks, owls, and game birds

was not forthcoming from any source other than direct observation, but there is generally a lot of shooting on these hunts "just for fun".

Table 2. Success of coyote drives for the winters, 1949-1950 and 1950-1951.

Place of hunt (County)	Date	Coyotes killed	Area (Sq. Miles)	No. of men
Clay County	1-1-50	22	49	1,000
Clay County	2-5-50	5	25	500
Clay County	2-22-50	4	49	200
Marshall County	1-22-50	52	144	3,000
Marshall-Riley County	1-23-50	24	64	1,200
Marshall County	2-3-50	10	36	800
Morris County	2-19-50	6	36	300
Morris County	1-21-50	23	36	800
Pottawatomie County	2-26-50	6	50	300
Riley County	3-5-50	4	9	300
Riley County		11	36	800
Wabaunsee County	2-20-50	14	36	500
Wabaunsee County	2-24-50	6	50	300
Dickinson County	1-6-51	9	6	200
Lyon County	2-4-51	10	36	250
Marshall County	12-29-50	33	12	850
Marshall County	1-24-51	24	144	1,500
Marshall-Riley County	2-3-51	11	110	600
Morris County	1-14-51	11	49	550
Morris County	1-14-51	16	36	575
Riley County	1-1-51	4	36	500
Riley County	1-19-51	12	64	400
Riley County	2-11-51	9	36	400
Fort Riley Reservation	2-22-48	54	72	2,500
Total		380	1,221	18,025
Average for 24 hunts		15.8	50.6	752

STEEL TRAPS

Steel traps have been used in this country by many generations of trappers, and although deemed by many persons to be inhumane, no other device as effective or easy to use is yet available to take their place.

Locations for setting traps can be selected by keeping in mind a few constant behavior patterns of the coyote.

Coyotes establish what are commonly referred to as "scent posts", or places where they regularly urinate, apparently as an indication to other coyotes that they have been there. The animals usually establish these posts along their runways on rocks, posts, bushes, or stubble of range grasses. Where ground conditions are right for tracking, these scent posts may be detected by accumulations of feces around the spot and the toenail scratches on the ground made by the animals after they have urinated. This habit of having scent posts and of scratching is similar to that in dogs. If a regularly used scent post can be found and traps properly set around them, frequent catches are certain.

Places where carcasses of animals have lain for a long time are often revisited by any coyotes in the vicinity, and offer excellent spots for setting traps. Other good situations are at the intersection of two or more trails, around old bedding grounds of sheep, and on knolls overlooking water holes. The end of a ridge, a knoll on the open prairie, or a rise at the intersection of two streams makes good trap locations because of the habit of coyotes of going frequently to high points, and of hunting along streams. Gates between pastures, old salt licks, or other bare spots in the range serve as gathering points and make good trap locations.

Traps should be clean with no foreign odor. Deodorizing may be done most effectively by letting the traps hang in the weather on the barn or other buildings. The traps may be boiled

in water containing lye, sage, blue stem, oak, walnut, or any number of other substances that remove or cover up human scent. Trap sizes three and four are recommended for coyotes. In making a set, a hole the length and width of the trap with jaws open is dug, into which the trap is fitted so that it will not rock. It has been recommended that, while digging, the trapper should stand on a square of canvas or piece of sheet or calf hide. If canvas is used, the human scent can be removed by previously burying it in a manure pile. The livestock scent acquired in this process is usually strong enough to counteract any later human scent. The human scent can be effectively removed from the shoes and gloves by rubbing them in barnyard or chicken house litter, and if so treated, no other precaution against human odors is necessary. Odors unusual to the range in which the traps are set should be carefully avoided. Chicken in a sheep range, or sheep in an area where sheep have not been can arouse the suspicion of the coyotes as much as human scent.

Steel traps are usually set in clusters of two to five, around the "scent post" or a bait station. If bait is used, three or more traps are more effective, set in a circle, about two feet out from the bait. If scent is used, two traps are usually sufficient.

The trap may be anchored or unanchored. If unanchored, drag hooks may be attached to a 6 ft. chain, fastened by a swivel to the trap. If a stake pin is used, it should be driven full length into the ground and attached to the trap by a length of chain. Anchoring the trap is the preferred method because animals

are obtained without a loss of time, but there is less chance of the animal pulling a foot off in the trap if the drag chain is used.

The next step is the burying of the trap. A space under the trap pan is cleared of all rocks, pebbles and dirt. A trap pad is cut from canvas, waxed paper or wire fly screen, to a shape which will lay over the pan, inside the open jaws of the trap. With the trap pad in place, the entire trap is covered with earth from the hole in which the trap is buried, or with dry, crumbly dirt from some spot in the immediate vicinity, if the dirt from the hole is sticky.

It is well to have the surface over the trap a little lower than the surrounding ground, for an animal will throw more weight on a foot placed in a depression, and thus is more likely to be caught higher on the foot, and with a firmer grip.

Coyote urine and the anal glands, mixed with glycerine at the ratio of three to one, makes an excellent scent. A few drops can be scattered on the ground six or eight inches from where the trap is set. The farther from a runway a trap is set, the more scent will be needed. If the animals become wise to this kind of scent, an effective fish scent may be prepared from the flesh of oily types of fish, such as sturgeon, eel, sucker or carp. Its use is not recommended, as it is very attractive to livestock, dogs, skunks, raccoon and opossum. Many varieties of scent have been used successfully. Unmodified coyote urine or urine mixed with any one of a great number of smelly substances, such as rose oil, cheap perfume, asafetida, skunk scent and so forth, have been

used successfully, particularly when the standard coyote lure proved ineffective.

The method that has been described here is used along coyote runways, where coyotes are attracted to the "posts" by the scent that has been dropped.

From the information that has been collected, it appears that the practice of setting traps in an area closely adjacent to the barnyard proper has produced excellent results. Sets that can be seen from the barnyard can be observed daily without approaching them. This practice results in a considerable saving in time, and less danger of leaving a human scent in the trap area than if the traps have to be visited occasionally to check them for a catch.

Many farmers who use sets near the barnyard have found that bait is much more effective than scent. The baits regularly used are dead poultry and scraps from butchering hogs, cows or sheep. In this case, it is much more convenient to cover the trap with litter from the chicken pen or from the sheep barn, rather than using a trap pad and covering the trap with dirt. This method is used by Pat Scott of Manhattan who caught 16 coyotes during the winter of 1950-1951, in a single set baited with dead chickens and covered with litter from the chicken house.

Of some two hundred questionaires sent to farmers and sportsmen, only ten replied with enough information about steel traps to be used for a comparison of effectiveness (Table 3). It is desirable that more information be obtained on steel traps,

but although many men reported using them, the ones that replied to the questionaires seemed to be the ones who are getting the best results. As nearly as can be estimated, there are probably not over 100 successful users of steel traps for coyotes in Kansas, and they average only three or four sets each.

Cooperators reported 201 coyotes caught in the 1949 to 1951 period, from 48 sets comprising 131 traps. Three or four traps per set were regularly used, although some used only two. It was noticed, however, that the men using sets of three or four traps caught more coyotes per set than those using two.

The information available shows that 4.5 coyotes per set, or 1.5 coyotes per trap were taken by the men reporting. Most of these sets were made close to the barnyard, so that the farmers could be reasonably sure that the coyotes they caught were those that were preying on their stock. These farmers generally used one to three sets only, so the initial cash outlay was not great. The bounty for one coyote pays for a trap, and the actual saving in livestock more than repays the farmer for his trouble in making the set. It appears that the long trap lines of 50 to 100 trap-sets passed from the scene with the decrease in value of coyote pelts.

Not enough emphasis has been placed on the efficiency of steel traps, and if they are used in areas where coyotes are known to cause losses, the operator has a better chance of catching the offending coyote rather than some coyote that is innocent of domestic stock depredation.

Table 3. Results of trapping coyotes with steel traps, 1950-1951, unless noted otherwise.

Cooperator	Address	No. of sets	Traps per set	Total traps	Coyotes caught
John Hall	Olathe	1	3	3	26
Richard Sowell	Manhattan	1	3	3	1
Pat Scott	Manhattan	2	4	8	26
Pat Scott	Manhattan (49-50)	2	4	8	16
Pat Scott	Manhattan (48-49)	2	4	8	17
Karl Fechner	Manhattan (49-50)	1	4	4	16
Karl Fechner	Manhattan	1	4	4	7
Jay Sanders	Sedan	4	4	16	5
Charles Sturgis	Sedan	3	2	6	10
Earl Asbury	Winfield	15	3	45	65
Garland Gideon	Paxico	4	3	12	29
R.W. Zolak	Burden	16	2	32	16
Total		52	40	149	234

CYANIDE GUNS

One of the recent developments in the science of predator control is the cyanide gun or "coyote getter". This piece of equipment is a coyote killer, not a trap, manufactured by Humane Coyote Getter, Inc., Pueblo, Colorado. It consists (Fig. 1) of a stake (a), which holds the firing unit (b), on which the shell holder (c), containing the cyanide cartridge is attached. The shell holder is dipped in paraffin, then wrapped with rabbit hide, cloth, or wool (d), on which the scent is placed with the gun is set. The hollow stake is filled 2/3 full of earth and driven down level with the surface of the ground (e). It can then be left for a period of time so that the coyotes may become acquainted with this "foreign object". Later, the trapper returns and installs the firing unit. A small amount of wool, fur, or other suitable material should be placed over the top of the stake, so that it will be folded around the firing

Humane Coyote Getter

Stake, which is first filled two-thirds full of dirt and driven into the ground by means of a bolt which just fits inside the stake.

Set Firing Unit, without chemical shell, ready to be placed in stake.

Setting Tool.

Live chemical shell in shell holder and dipped in hot para-wax. This chemical shell is now ready to be wrapped with the fresh rabbit hide, wool or cloth.

Live Chemical Shell, covered with either rabbit hide cloth or wool with the tip dipped in hot paraffin. If the rabbit hide is used it is well to allow it to dry a day or two before dipping in the paraffin. The prepared bait is then ready for the coyote.

Method of driving the stake into the ground by use of inserted bolt.

FIG. 1. Directions for using coyote getter.

unit as it is put in place. This fur or wool serves in preventing a rattling noise should the coyote nose or paw the getter before pulling it, and, if wet with mineral oil, serves to keep the firing unit from freezing in the stake in cold and wet weather. A small hole should be dug in the ground alongside the wire clip on the stake in order to make a place for the trigger to rest and work. This hole can also be lined with wool and covered lightly with dirt.

After the firing unit is in the stake, the shell holder can be screwed on and the lure added. The baited shell holder should be the last to be put on in setting a "getter", and the first to be removed while taking up a set. While attaching or removing the loaded holder, pressure should be exerted downward only, as the gun can be discharged with any pull on the bait. Although the coyote "getter" is not fatal to humans unless the charge is taken directly into the mouth and swallowed, it can give painful burns. It is very irritating to the eyes.

When the coyote pulls the bait, the trigger, which is fastened to the stake, releases the firing pin, which in turn causes the shell to fire, and ejects the chemical into the animal's mouth. Death occurs within a few seconds, and the coyotes usually are found 40 to 100 yards from the set.

Correct placement of the guns is essential, since a getter placed without care is apt to cause the death of animals other than coyotes. Naturally, since dogs and coyotes feeding habits are much the same, there can be a minimum amount of protection to dogs in an area in which getters have been placed. Numerous

complaints have been registered regarding the destruction of cattle and sheep. (A large stone placed at the side of a getter will prevent a cow from biting down on the bait, but the narrow muzzle of a coyote can readily reach it. Some patience, as well as experimentation with sets must be practiced by the user. Sets should not be made on straight runs or open fields, but rather in such places as forks of roads or trails, fence corners, old bone piles, banks and ridges, and other places where coyotes congregate as described under "trapping".)

Twenty-six operators of coyote guns contributed considerable information on their methods of use, for the years 1947 through 1951 (Table 4). Two hundred ninety-one guns were in use, and 474 coyote carcasses were recovered. On this basis, 1.6 coyotes per gun were accounted for.

The amount of information that has been acquired on cyanide guns seems to be adequate. More information from the western part of Kansas would have been desirable, since the coyote population there is considerably less than in the central portion of the state, and results of cyanide gun use would probably be different than that presented here.

Table 4. Results of cyanide gun use for 1950-1951, unless noted otherwise.

Cooperator	Address	No. of guns used	No. of coyotes killed
Glenn Perkins	Howard	4	3
John F. Hall	Olathe	2	4
M.N. Thomas	Coldwater	38	24
Lyle Schaulis	Wakefield	3	1
Roy R. Rau	Wakefield	25	21
Harvey Benson	Clay Center	5	4
Glenn Lauer	Westmoreland	15 (47-48)	18
Glenn Lauer	Westmoreland	15 (48-49)	24
Glenn Lauer	Westmoreland	15 (49-50)	42
Glenn Lauer	Westmoreland	15	30
Wendell Kleiner	Keats	6 (49-50)	17
Wendell Kleiner	Keats	6	22
Allen McInteer	Manhattan	6 (48-49)	34
Lester Beiter	Manhattan	6	14
Jack Hofman	Manhattan	6 (48-49)	17
Jack Hofman	Manhattan	6 (49-50)	29
Paul Ehm	Manhattan	4 (49-50)	17
Paul Ehm	Manhattan	4	6
Neal Glass	Neal	20	20
George R. Burt	Concordia	5	26
Albert O'Toole	Arnold	20	34
Clarence Hanna	Penokee	8	10
Kenneth Grover	Menlo	6	4
Kermit Knudson	Levant	6	1
Henry Soden	Levant	6	4
Roy Brenn	Levant	15	12
Guy Henry	Colby	8	0
Marshall Dulton	Colby	20	0
A.J. Ketchum	Rexford	5	2
Harlan Hittle	Winfield	1	11
Abe Elaue	Winfield	2	4
Noel Scott	Winfield	1	1
V. Glotzbach	Paxico	10	17
Vern Setzer	St. George	7	5
Total		291	474

DEN HUNTING

There is probably no more efficient method of preventing excessive increases in coyote populations than to destroy the newly born pups before they abandon the den to shift for themselves.

Many months of strenuous effort can thus be saved trying to rid the range of the predators after they have reached maturity.

Coyotes are particularly destructive during the denning season because of the need for extra food for themselves and their young. Sheep and calves on open ranges and chickens that run into brush or other heavy cover suffer the greatest depredation. Coyotes that kill lambs and calves during April and May generally have dens, and when the dens are located and the pups destroyed, the killing usually stops. Possibly the old coyote can be destroyed at the same time, and if so, the losses are certainly reduced if not eliminated entirely.

Coyotes do not select denning sites according to any recognizable rule, but many of them return to the same general locality year after year, even though dens are regularly dug out and the pups killed by den hunters. If the female is killed, the male may bring his new mate to the same locality the next season.

Dens may be found in a canyon, washout, on a bank or hillside, in a rock bluff, or even on level ground as in a pasture, a wheat field, or plowed field. Whenever possible, instead of digging new dens, coyotes will enlarge abandoned badger, ground hog, or rabbit holes. Usually they start cleaning out the holes several weeks prior to whelping, which occurs in Kansas during the latter part of April through the first two weeks in May.

The proper time for hunting coyote dens is from May to the middle of June. If hunting is begun to early, before some of the pups have been born, the territory will have to be covered again.

The coyote den is usually made in rough terrain and is normally within reach of water. Coyotes do not go to water until they are several months old.

Den hunting should be systematic and thorough. The general location of a den may occasionally be learned by hearing the howling of the coyotes, or it may be located by tracking, by watching for the old coyotes, or by riding the range looking for holes. A good time to hunt dens by tracking is just after a rain. Another good time is the day after a severe wind storm as storms restrict the activity of coyotes.

Coyotes with dens have regular hunting grounds to which they usually travel on a nearly straight course, whether near or several miles distant, and return on a nearly direct line after they have made their kills.

When the den is in danger of being discovered, coyotes act in a nervous manner. Some will circle about it at a distance when the hunter is near; the old female may be seen in one direction and after disappearing may later be seen peering over a hill in another direction. When a female with a den first sees a person, she looks first at him for a moment, then almost invariably toward the den, sometimes turning completely around to do so.

The digging necessary to capture the pups depends largely on the location of the den. Some dens are so shallow that little or no digging is required although some burrow straight into a bank or under a hardpan ledge. Where digging is extremely difficult, and the pups cannot be taken by other means, the animals

may be disturbed and induced to move, frequently to a den from which they can readily be taken. If the pups can be seen back in a den but cannot be reached, a forked stick has been used to catch in their fur and pull them out. Some individuals have used a length of barbed wire, one end of which is attached to a crank-like device. As the length of wire is pushed into the den, it is rotated slowly, and as the barbs come in contact with the fur of the pups, it becomes entangled and the pup can be removed from the den by withdrawing the wire. The method has been used quite successfully in dens or burrows that branch or turn, and the den is left undamaged for use of other animals.

Questionaires were sent to the clerks and treasurers of 75 counties with the request that they record separately the number of pup scalps turned in for bounty in April, May and June, 1951 (Table 5). Forty-five counties replied. A total of 8,026 bounties had been paid, 5,530 (68.9 percent of the total) which were for pup scalps.

In most of the counties reporting, some pups were destroyed before they left the den. Since these counties are well distributed over the state and give a general representation of the pup-take, it could possibly be concluded that some 10,000 coyote pups were destroyed this past spring. In general, den hunting is most intensive in the Flint Hills, and least practiced in the western 1/3 of the state.

Table 5. Results of den hunting, April, May and June, 1951.

County reporting	No. of bounties Second quarter 1951	No. of pups
Anderson	336	303
Atcheson	74	30
Bourbon	100	100
Butler	383	250
Cherokee	55	12
Cheyenne	86	82
Cloud	280	190
Decatur	164	25
Dickinson	148	14
Edwards	41	26
Ellsworth	230	185
Finney	108	4
Franklin	301	238
Gray	20	6
Greeley	4	0
Greenwood	555	396
Jackson	405	355
Kingman	101	80
Labette	95	70
Lane	114	38
Leavenworth	112	73
Linn	124	60
Marion	246	196
Marshall	310	204
McPherson	81	67
Montgomery	252	12
Morton	35	24
Nemaha	302	275
Norton	206	101
Osage	193	142
Ottowa	125	80
Phillips	3	0
Pottawatomie	456	438
Pratt	115	40
Republic	170	157
Reno	103	5
Saline	156	53
Stevens	18	10
Thomas	60	8
Trego	256	196
Wabaunsee	237	110
Washington	362	325
Wichita	3	0
Wilson	423	395
Woodson	178	155
Total	8,026	5,530

COMPOUND 1080

Sodium fluoroacetate, commonly known as Compound 1080, has been used for the past six years as a coyote poison by the Predator and Rodent Control Division of the U.S. Fish and Wildlife Service, and at the present time can be used only by Fish and Wildlife Service employees who have been specifically designated to do so. For the past six years, that agency has been conducting laboratory experiments and field tests under varying conditions in western states to determine the adaptability of 1080 for use in controlling coyotes destructive to livestock and game. They believe that when intelligently applied, this agent can be used to effectively control coyotes with minimum damage to other wildlife, and in many instances proves beneficial to populations commonly preyed upon.

The Kansas Fish and Game Commission has not established a policy on the use of 1080 (Leahy). Compound 1080 was used in Kansas for the first time in the winter of 1950-1951. Only three counties, Meade, Seward and Clark, requested the Fish and Wildlife Service to establish stations within their borders, and reports to the present time indicate a rather high kill. An exact count of coyotes killed by 1080 is often difficult to obtain, since coyotes tend to "den up" as the poison begins to affect them. For this reason, effectiveness of 1080 stations is difficult to determine.

The following data were made available. In Clark County, 4,800 pounds of horsemeat was used, and 21 stations were established over an area of 640,000 acres. Seward county used

seven horses for bait, but the number of stations established is not known. Information on Meade county is lacking. Clark county reported 204 coyotes picked up during and after the poisoning program, although earlier estimates were as high as 800 to 1,200 coyotes killed (Bird, 1951). The inhabitants of these counties reported to their county agents that they had suffered almost no losses to coyotes in the late winter and early summer, but by mid-summer they were again having some poultry losses.

The 1080 program in Kansas will present a different picture in 1951-1952 if present plans go ahead as scheduled, as 12 counties, Clark, Finney, Gray, Meade, Morton, Kiowa, Seward, Barber, Stevens, Haskell, Grant, and Comanche, have requested its use for coyote control. Mr. A.E. Gray of the Predator Control regional office at Oklahoma City, Oklahoma, has effected contracts with the named counties, and establishment of the 1080 stations began on December 7, 1951. Information on the number of stations set is not yet available.

DISCUSSION

Before any satisfactory conclusions can be formulated for an acceptable coyote control program for Kansas, attitudes and practicability must be taken into consideration. Cattlemen and sheep and poultry raisers have long argued for all-out warfare against the coyotes. Naturalists and wildlife authorities have encouraged limited control, being in favor of the reduction of the coyote population to the point where it can be supported adequately by the rabbit and rodent populations, and at the same

time, continue to serve as a check on the rodents and rabbits. This study was not intended to present a solution to the problem that would be wholly acceptable to any one group, but rather to present a solution that would be best for everyone involved. There can be no argument with facts, but the interpretation of those facts must be made so as to present as broad a picture as possible of the effectiveness and economy of the various methods now in use.

Emphasis must be placed on the economy, efficiency, and practicability of a method of coyote control before it can be accepted. It should be a method that does not "over-control" or be hazardous to other forms of wildlife. Should it be indicated in any way that a method could lead to the eventual eradication of the coyotes in a given area, that method should be re-examined and possibly discarded, since the coyotes on the range function as a valuable rodent and rabbit control agent. Serious damage to crops would result if this control on rodents and rabbits were removed. The Kansas State College coyote study showed in an analysis of 960 stomachs that 60 percent of the coyote diet consists of rabbits and rodents. This factor is usually neglected when the coyote question is discussed, but for the benefit of the farmer who contends with the coyote daily, serious thinking should also be given to the saving in crops as a result of coyote activities.

Except for a few talented dog handlers, hunting coyotes with dog packs can be justified only by the sport involved, but most of the letters that have been received have failed to mention

this point. The maintenance of dog packs has been popularly justified on the grounds that they are valuable instruments of coyote control. However, the owners of packs have neglected to take into account the cost of maintaining dogs for this purpose. Estimates, based on the present cost of dog food, show that the minimum cost of feeding a dog is about $40.00 a year. This is an important fact, since a dog would have to account for some 20 coyotes a year to earn his board, at the present bounty of $2.00 for each coyote, unless the dog owner is also the farmer who is being protected.

It has been argued that the savings in domestic livestock by killing one coyote would justify the maintenance of a pack. This is not necessarily true, since many coyotes are not predatory on domestic animals, and the death of a coyote that normally eats rodents would be of no benefit to the farmer. If the farmer knows the approximate range of a killer-coyote, there is a good chance that the dogs may get the animal that has been doing the damage.

If the value of dog hunting as a sport were to be discounted, certainly this method could not be justified as a means of coyote control, but most of the owners of dog packs derive so much pleasure from handling the dogs and hunting with them, that dog hunting cannot be evaluated on a monetary basis, and the control value derived from this sport can be considered as almost free. It must be noted that a few farmer-sportsmen become extremely proficient in training and handling dogs, and efficiently control coyote losses in their immediate neighborhood.

Coyote drives lack efficiency, economy, and practicability as an effective means of coyote control. The coyote drives, as they are conducted at present, require too many man-hours and too many dollars in sporting equipment to accomplish the elimination of one coyote. There is no economy in spending $10.00 for sporting equipment if the end result is the saving of $10.00 worth of chickens.

Many sportsmen have voiced objections to these drives, and believe that any good done by the destruction of coyotes is nullified by the killing of birds known to be predators on small mammals. The common victims are the Short-eared Owl, Marsh Hawk, and Red-tailed Hawk. These birds, usually beneficial to the farmers, should be protected. Some Great-horned Owls also are killed and occasionally a Cooper's Hawk is hit. The amount of accessory killing varies considerably among hunt clubs and depends mainly on the attitude taken by the leaders.

The chief justification for these drives will continue as it has been in the past, recreation and sport, not a control, and unless something can be done to reduce wanton slaughter of hawks, owls, and rabbits, this method will continue to lose favor among true sportsmen and should be discouraged.

Steel traps, as reported by ten trappers, are still the most efficient and adaptable means of coyote control. Although the excitement of the chase and the thrill of the kill are lacking, there are certainly some sporting qualities to be associated with the use of steel traps. The very act of being able to outwit the wary is a sport in itself. However, the more obvious

advantages lie in the efficiency and the cost of steel traps for coyote control.

Steel traps were demonstrated to be 150 percent effective on the coyote-per-trap basis for the area of the state reporting. The cost of steel traps is not great, - about $1.50 per trap for #3 and #4 traps. One operator, listed in Table 3, using 45 traps, caught 65 coyotes in one season, for which the bounties more than paid the initial cost of the traps, to say nothing of the protection resulting from this catch.

A day by day check is easily made if the traps are located at strategic positions near the barnyard, and sets so made afford the greatest protection. Such sets allow more chance of catching coyotes bent on livestock depredation than do those sets on the open range.

Cyanide guns have been proved an effective and economical means of coyote control, but carelessly placed guns can be a great detriment to the operator. They have been demonstrated to be 160 percent effective, on a coyote-per-gun basis, by the men reporting. The operation of cyanide guns is more time consuming than traps, since sets are usually made at least a quarter of a mile apart, and not closer than a quarter of a mile from farm buildings. The average of 9 guns per operator reported would comprise a line at least two and a half miles long, and would require about an hour to check. The only sport that seems to be involved in the use of cyanide guns is the outwitting of the coyotes with a variety of scents, and the chance of shooting one while making the rounds.

The cost of the equipment is about the same as for steel traps. The price, as quoted by the manufacturer, is $1.25 each. Chemical shells are six cents each, and the prepared scent is $1.00 an ounce. Bounties from the average first year's kill should pay for the equipment.

There were a few reports of deaths of other animals, but it is maintained by successful operators that if permission is obtained from the owners of the land on which cyanide guns are to be used, and all persons connected with this area informed of their use, then the only livestock that will be lost will result from carelessness. Although these guns are potentially dangerous to man, no serious accidents have been reported.

Den hunting is probably the most efficient method of keeping the coyote population under control. The practicability of destroying the young coyotes before they leave the den is obvious. If conclusions for the entire state can be drawn from results reported for one-third of the state, then 10,000 coyotes, one-third of the total kill last year, were pups, and most of those were from the eastern half of the state. If this number of coyotes were to be added to the overall picture by elimination of den hunting, the coyote problem of that part of the state would be critical. The value here can be considered more as a check on total population than as a direct control, although some dens are located and destroyed because of predation of the adults involved on neighboring flocks.

There has not been enough publicity on den hunting throughout the state, probably because the destruction of dens is illegal.

The individuals who seem to be best acquainted with den hunting are the boys on the farms. Their efforts directed toward getting pups from dens seem to be more for the bounty received than for the actual value as a method of controlling coyotes. Locating a den may be time consuming, but the value derived from catching a litter of coyotes offsets the disadvantages of the time element. There seems to be less sport involved in den hunting than any of the previous methods discussed. A good knowledge of the habits of the coyotes is a valuable aid to successful den hunting, and could be developed into a fascinating pastime.

Compound 1080 is the newest, deadliest and surest predator "control" agent that has ever been introduced into Kansas. There is no question as to its lethal qualities, and to date there is no known antidote. Its use has had numerous effects on wildlife populations other than coyotes.

The Fur Resources division, Oregon State Game Commission reported that, since the adoption of a 1080 program, there has been an increase in antelope and deer populations accompanying the rapid decline in coyote numbers. State game personnel that have accompanied the federal trappers while visiting 1080 stations have reported no apparent destruction to other wildlife. Some jack-rabbit control will be necessary in western Oregon in 1952, and two open seasons (1950 and 1951) were declared on Sage Grouse.

The Utah State Game Commission believes that the extensive use of 1080 in their state has reduced the coyote population to

the lowest numbers they have on record. They make no commitments as to its destruction to other forms of wildlife. It was noted that since the decline of the coyote population, there has been a rapid increase in the porcupine population, but no correlation is positively indicated.

The state of Arizona has made a study as to the effects of coyotes on the antelope herds, and has found that the annual increases in the survival of fawns is tripled or quadrupled where coyotes are completely eliminated. Although 1080 has been used in Arizona for the past six years, no particular increase in rodent numbers is recorded where coyotes have been cut to a very low population level.

There have been many criticisms of the use of 1080 in range country, to the effect that cattle have been killed at poison stations. The Denver Research Laboratory, U.S. Fish and Wildlife Service, conducted a series of tests to determine 1080 tolerance of various species, and has compiled the information given in Table 6, which indicates that 1080 is almost a specific poison for coyotes, dogs, foxes and related species, and that it would be almost impossible for a cow to get enough poison from a station to kill it.

Table 6. 1080 tolerance for various animals and birds

Animal or bird	Weight (lbs.)	MLD for 1080 Mg/Kg	Resistance compared to that of coyotes	Lethal amounts of station meat
Coyote	23	0.10	1	1-2 ozs.
Grey Fox	8	0.30	1	Less than 1 oz.
Dog	26	0.07	1	Less than 1 oz.
Bobcat	22	0.66	6	6.6 ozs.
Badger	15	1.25	10-15	7-10 ozs.
Raccoon	13	2.00	20-30	12 ozs.
Opossum	6.5	60.00	600	11 lbs.
Magpie		0.70	7	0.16 ozs.
Golden Eagle	8.8	5.00	50	1.25 lbs.
Hawks	2.2	10.00	100	10 ozs.
Great Horned Owl	2.2	10.00	100	10 ozs.
Turkey Vultures	5.5	20.00	200	3 lbs.
Man	154	2.00	20	8 3/4 lbs

There is no information as to the toxicity of 1080 to cattle. However, based on the tolerance of a goat (.3 mg/kg) and of a horse (1.0 mg/kg) - if cattle are as susceptible as goats - then a 660 pound cow theoretically may be killed by the 1080 contained in five pounds and ten ounces of meat; if a cow is as resistant as a horse, the theoretical figure would be the 1080 in eighteen pounds and twelve ounces of station meat (Kalmbach, 1950).

There have been many facts, and even more fancy presented about the mysterious qualities of 1080, and it is difficult to determine where one leaves off and the other begins. It is hard to believe that the thousands or even possibly millions of pounds of 1080 treated meat that have been set out have killed only coyotes. Here in Kansas, in one county alone, 4,800 pounds of 1080 poisoned meat were put out in stations, and all but 600 pounds had been cleaned out before the end of the season. Only 204 coyotes were recovered. Earlier estimates were that 800-1,200 coyotes had been poisoned. This number seemed unreasonably high at the time it was given, but considering the possibility that all the meat had been eaten by 1,000 coyotes,

4.2 pounds of meat would have been consumed by each coyote. This is a fantastic figure, since in the Kansas State College coyote study it has been found that a coyote will eat on the average only 1.5 pounds of meat at a feeding, and the 1080 in considerably less meat is considered a lethal amount. It appears from information available that few coyotes can eat as much as four pounds in a day.

The obvious question is, what became of the remainder of the poisoned bait. How many other animals suffered, and if they did, why was it not reported? The amount of meat that is a surplus beyond the amount that 204 coyotes could eat would kill an enormous number of animals. That is one reason why an investigation of the characteristics of Compound 1080 must be carried further than they have been at this time.

It is significant that no adverse effects on wildlife were reported by the state game commissions contacted, since there would be no reason for permitting wanton slaughter of their wildlife. Such accounts of coyote control with 1080 can be given considerable weight on the credit side of the question, and yet there are ranchers, naturalists, and individuals who are interested in wildlife who have reported seeing many dead birds, squirrels, chickens, cows, and the like near 1080 stations. Nevertheless, and it is important, that so far as can be found, none of these reports of mass killing has ever been verified by a recognized authority.

Several sources of information maintained that the use of 1080 is not strictly supervised and that losses to other forms

of wildlife have been permitted to occur. However, the use of poisons against coyotes is occasionally desirable in certain areas and at certain times of the year, and it is believed that an effective and economical means of coyote control can be formulated with 1080 if its use is strictly controlled.

A number of coyotes are killed by shooting on individual hunts, but there is no way of estimating the frequency or results of such hunts. Numerous coyotes are killed on the highways annually, and some individuals have found considerable sport in running coyotes down with automobiles in open fields.

RECOMMENDATIONS

In line with the evidence accumulated and presented here, it has become apparent that no single method of coyote control is suitable for the conditions varying from the open rangeland of the southwest to the densely populated regions in the northeast.

The following methods of coyote control are therefore recommended:

1. All coyote drives should be supervised by an official of the Kansas Forestry, Fish, and Game Commission to prevent the wanton destruction of desirable species of birds and mammals.

2. Cyanide guns should be used wherever practical, but only with permission from all persons living in the area in which they are to be set. They should not be used where livestock have access to them, and they should not be set closer than 1/4 mile to any farm building.

3. Hunting coyotes with dogs and planes and individual hunting for sport should be encouraged.

4. The advantages of den hunting should be publicized and restrictions on digging out coyote dens should be removed.

5. Compound 1080 should be limited to the "rangeland" in the state and stations established only with cooperation with officials of the Kansas Fish and Game Commission. A full report should be made public at the end of each season, giving the amount of station meat consumed, the number of coyote carcasses recovered, and a list of any other forms of wildlife killed at 1080 stations.

In order to get any effective control of coyotes in Kansas, it will be necessary to have at least two full-time technicians under the Kansas Fish and Game Commission and the Kansas State College Extension division to coordinate activities and demonstrate methods of control.

SUMMARY

Information on coyote control was collected from approximately 2,000 individuals, either personally or by questionaire.

The methods of control, in order of the number of coyotes accounted for, are: den hunting, "wolf hunts", dog-hunting, cyanide guns, steel traps, airplane hunting, 1080, and individual hunting with rifles.

Den hunting accounts for about one-third of the annual take, is an individual project, and is an efficient means of total population control, as well as an important specific control.

"Wolf hunts" are expensive, destructive, and inefficient, but because of the great number of people participating, account for many coyotes in the eastern half of the state and are

important as sporting events.

Hunting with dogs is fundamentally a sport that incidentally results in the destruction of a goodly number of coyotes. Airplane hunting is also mostly sport, but both of these systems may be developed into effective control measures.

Cyanide guns are used rather extensively, are more easily set than steel traps, and are about as effective as traps. They are objectionable because of the danger to dogs and livestock.

Steel traps are not used as extensively as cyanide guns, but are more adaptable, more selective, and less dangerous.

Compound 1080 is new in Kansas, but is cheap, efficient, and thorough. The effect of 1080 on other animals is problematical and is the big drawback on extension of its use.

ACKNOWLEDGMENT

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LITERATURE CITED

Barker, E.S.
New Mexico Department of Game and Fish, Santa Fe, New Mexico. Letter to William F. Gusey, dated November 14, 1951.

Bird, B.
Clark County Farm Bureau, Ashland, State of Kansas. Letter to William F. Gusey, Dated May 22, 1951.

Gabrielson, I.N.
Wildlife conservation. New York: Macmillan Company, 1947.

Gier, H.T., D.J. Ameel and O.W. Tiemier.
Factors influencing coyote populations in Kansas. Unpublished bulletin, Zoology Department, Kansas State College, 1950.

Hamilton, W.J.
The mammals of the eastern United States. Ithaca, New York: Comstock Publishing House, 1943.

Hansen, G.H.
U.S. Fish and Wildlife Service, District One. Letter to William F. Gusey, dated November 8, 1951.

Kalmbach,
1080 tolerance for various animals and birds. Memorandum to Fish and Wildlife Service District Agent, Portland, Oregon, District One, October 31, 1950.

Leahy, D.
Forestry, Fish and Game Commission, State of Kansas. Letter to William F. Gusey, dated October 24, 1951.

APPENDIX

EXHIBIT A. Form sent to farmers and sportsmen for information on coyote control methods.

Information on Coyote Control

Method used:	No. of Cy. guns, traps, dogs used	Coyotes killed	Degree effective
Steel traps			
Dog Packs			
Cyanide guns			
Planes			

Information supplied by _____

Address _____

THIS SIDE OF CARD IS FOR ADDRESS

Hunter's Name

Address

EXHIBIT B. **Questionnaire sent to sportsmen for information on coyote hunts.**

Information on Coyote hunt

Place of hunt _____
Area covered (Sq. Miles) _____ Date _____
Number of coyotes killed _____
Number of men participating _____
Estimate of success of hunt _____
Cards needed for reporting future hunts _____
I (can, cannot) get information on (hunting with dogs, with planes, trapping, cyanide guns).

Information supplied by _____
Address _____

THIS SIDE OF CARD IS FOR ADDRESS

Hunter's name
Address

EXHIBIT C. Form used in collecting data from county clerks.

Record of Coyote bounties paid in _____

county in May, June and July, 1951

Name and Address	Date	Number of Adults	Number of Pups

EXHIBIT D. Form sent to county clerks not reporting numbers of pups taken in second quarter, 1951, at the first request.

_____ County

Total number of coyotes turned in for bounty in April, May and June, 1951.

_____

How many of the total number of bounties paid were for pups?

_____

THIS SIDE OF CARD IS FOR ADDRESS

County Clerk
_____ County
_____, Kansas

EXHIBIT E. Form sent to farmers, hunters and sportsmen for information on coyote control methods.

Data on Steel Traps
1950-1951

Cooperator and Address	Number of sets	Number of traps per set	Number of coyotes caught	Bait

Data on Cyanide Guns
1950-1951

Cooperator and Address	Number of guns used	Number of coyotes killed

Data on Dog Packs
1950-1951

Cooperator and Address	Number of coyotes killed	Number of dogs used	Number of hunts	Average number of men

METHODS OF COYOTE CONTROL IN KANSAS

by

WILLIAM FRANKLIN GUSEY

B.S. WILLAMETTE UNIVERSITY, 1950

AN ABSTRACT OF A THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

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KANSAS STATE COLLEGE
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1952

A study of coyote control methods in Kansas was believed necessary in the face of serious depredation by coyotes on domestic stock. In the past three years, the cost to the farmers, as a result of coyote activities, has risen almost to the two million dollar mark annually.

A study of control methods was begun in the fall of 1950, and as a result, many new factors of coyote control have been brought to light. Data was obtained from farmers and sportsmen by interviews and questionaires.

Seven methods of coyote "control" were found in use in Kansas: coyote drives or "wolf hunts", dog-hunting, plane hunting, steel traps, cyanide guns, den hunting and 1080 poisoning. A few animals are killed on individual hunts and by cars. Each of these methods has points in its favor, but all are objectionable under some conditions.

Coyote drives were chiefly for sport, accomplishing little in the over all picture of coyote control, and proving detrimental to wildlife in general. In 24 drives for which information was available, an average of 50 square miles was covered, involving 752 men and netting 15.8 coyotes for each drive. This means 48 men covered 3.2 square miles for each coyote killed.

Dog packs were used for sport, but on the coyote-per-dog basis were fairly effective. The cost was the chief deterring factor in the consideration of this method as an efficient control method. Data was available on 152 dogs in 27 packs. They were used on 648 hunts and caught 1015 coyotes. Two and

one half dog hunts per coyote were necessary, and 6.6 coyotes per dog were accounted for.

Steel traps proved most effective near barns and barnyards. Under these conditions, available data shows that 234 coyotes were caught in 149 traps comprising 52 sets, averaging 4.5 coyotes per set, or 1.5 coyotes per trap.

Cyanide guns are best suited to open, unstocked range, since they have killed animals other than coyotes when carelessly used. Data from 27 men, using 284 guns shows 469 coyotes destroyed, averaging 1.6 coyotes per gun.

Den hunting accounted for 69 percent of the coyotes turned in for bounty in the second quarter of 1951 in the 45 counties reporting. This is a desirable form of control as a means of restraining the coyote population.

Compound 1080 was used in three counties in the winter of 1950-1951. In Clark county, 4800 pounds of horsemeat were poisoned, and used in 27 stations. Results are inconclusive, but 204 coyotes were picked up after the poisoning program. There can be serious questions as to what happened to the rest of the poisoned meat.

As a result of the information gathered, the following recommendations are presented for future control of coyotes in Kansas:

1. All coyote drives should be supervised by officials of the Kansas Forestry, Fish and Game Commission.

2. Cyanide guns should be used whenever practical, but never when they will endanger livestock.

3. Hunting coyotes for sport should be encouraged.

4. Restrictions on den hunting should be lifted, and this form of control should be publicized.

5. Compound 1080 should be used in cooperation with Kansas Forestry, Fish and Game officials, and reports of its use should be made public.

6. Two full-time technicians under the Kansas Forestry, Fish and Game Commission and the Kansas State College extension division should be employed to coordinate control activities.

This report should stimulate new thinking toward a solution of the problem of coyote control in Kansas, and it is hoped that with this data available, positive action will be taken.